Name: __________ Date: __________

Polynomial Operations SOLUTIONS (version 34)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 + 8x^3 + 6x^2 + 7x + 4$$
$$q(x) = 3x^5 - 10x^4 + x^3 - 9x^2 - 8$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$p(x) = (-9)x^5 + (0)x^4 + (8)x^3 + (6)x^2 + (7)x^1 + (4)x^0$$
$$q(x) = (3)x^5 + (-10)x^4 + (1)x^3 + (-9)x^2 + (0)x^1 + (-8)x^0$$
$$q(x) - p(x) = (12)x^5 + (-10)x^4 + (-7)x^3 + (-15)x^2 + (-7)x^1 + (-12)x^0$$
$$q(x) - p(x) = 12x^5 - 10x^4 - 7x^3 - 15x^2 - 7x - 12$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 2x^2 - 8x - 4$$
$$b(x) = 5x + 6$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$-8x$	-4
$5x$	$10x^3$	$-40x^2$	$-20x$
6	$12x^2$	$-48x$	-24

$$a(x) \cdot b(x) = 10x^3 - 40x^2 + 12x^2 - 20x - 48x - 24$$

Combine like terms.

$$a(x) \cdot b(x) = 10x^3 - 28x^2 - 68x - 24$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 16x^2 + 11x - 26 \\ g(x) &= x + 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & 2 & 16 & 11 & -26 \\ -7 & & -14 & -14 & 21 \\ \hline & 2 & 2 & -3 & -5 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + 2x - 3 + \frac{-5}{x+7}$$

In other words, $h(x) = 2x^2 + 2x - 3$ and the remainder is $R = -5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 16x^2 + 11x - 26$. Evaluate $f(-7)$.

You could do this the hard way.

$$\begin{aligned} f(-7) &= (2)\cdot(-7)^3 \; + \; (16)\cdot(-7)^2 \; + \; (11)\cdot(-7) \; + \; (-26) \\ &= (2)\cdot(-343) \; + \; (16)\cdot(49) \; + \; (11)\cdot(-7) \; + \; (-26) \\ &= (-686) \; + \; (784) \; + \; (-77) \; + \; (-26) \\ &= -5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-7)$ equals the remainder when $f(x)$ is divided by $x + 7$. Thus, $f(-7) = -5$.